Office of Operating Experience Analysis, EH-33 • U.S. Department of Energy • Washington, D.C. 20585

OPERATING EXPERIENCE WEEKLY SUMMARY

Office of Nuclear and Facility Safety

November 13 - November 19, 1998

Summary 98-46

Operating Experience Weekly Summary 98-46

November 13 through November 19, 1998

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EVENTS

1. DEFECTIVE POWER SUPPLY ON WELDING MACHINE

On November 10, 1998, at the Savannah River Site, a pipe fitter using a portable electric drill motor noticed that it was smoking. He stopped using the tool and notified his supervisor of the condition. The pipe fitter had powered the tool through a 50-foot extension cord from a utility receptacle on a gasoline-powered portable welding machine. After the occurrence, electricians checked the receptacle and measured an open-circuit voltage of approximately 220 V ac instead of the design voltage of 110 V ac. The abnormal condition at the receptacle presented a significant risk to the employee using the drill motor. (ORPS Report SR--WSRC-CSWE-1998-0013)

Investigators determined that the pipe fitter was using the drill motor on a scaffold. They believe that the welding machine became grounded to the scaffold by inadvertent contact with a pipe that was being welded. They also believe that voltage and current surged at the receptacle when another pipe fitter struck a welding arc while the drill motor was in contact with the scaffold. Investigators have not yet determined the specific cause of the voltage anomaly. OEAF engineers will track this occurrence and will provide additional information as it becomes available.

Pending further investigation of this occurrence, managers of facilities that use or maintain portable welding machines should alert personnel to the possibility of excessive voltage on auxiliary receptacles and should discontinue the use of auxiliary receptacles.

KEYWORDS: power supply, voltage, welding

FUNCTIONAL AREAS: Construction, Industrial Safety

2. AMERICIUM-241 CONTAMINATION DURING REMOVAL OF LEGACY MATERIAL

On November 10, 1998, at the Los Alamos National Laboratory, a Material Research and Processing (NMT-11) employee's personal clothing became contaminated while she was removing legacy items from a chemical fume hood at the Chemistry and Metallurgy Research (CMR) facility. Surveys of the clothing indicated alpha activity as high as 56,000 dpm/100 cm^2. The principle contaminant was americium-241. Radiological control technicians (RCTs) assisted the NMT-11 employee into clean clothing and discarded the contaminated clothing. She submitted nasal smears, which indicated slight alpha contamination. She began a special bioassay program and was restricted from working in radiologically controlled areas pending bioassay results and radiation dose assessment. Investigators determined that the employee had worked without RCT coverage, without a specific work plan or Radiological Work Permit (RWP), and without extremity dosimetry while handling radioactive material with unknown dose rates. (ORPS Report ALO-LA-LANL-CMR-1998-0041)

In June 1998, waste management personnel removed legacy chemicals from the fume hood in accordance with an RWP that required coveralls, two pairs of gloves, two pairs of booties, and a skullcap. In October, the Material Research and Processing group wanted to remove additional legacy items (empty sample bottles and cans) from the hood, but they did not initiate a specific RWP for this task. The

NMT-11 employee removed smaller bottles and cans from the hood, leaving only a large lead-lined can labeled as containing americium and another can with no label. Investigators learned that in spite of the labeling, the NMT-11 employee and her team leader assumed that the two cans were also empty, like the smaller bottles and cans, and could be handled the same way.

During the week of November 2, the NMT-11 employee attempted to discard the remaining two cans. She worked alone and without RCT coverage, wearing a cloth lab coat, two pairs of gloves, booties, and a personal dosimeter. Using a glovebag, she opened the unlabeled can and found within it another can labeled as containing neptunium. Inside that can was a cardboard carton, also labeled neptunium. The employee opened the carton and removed a glass jar containing black chunks of material, then placed the jar back into the carton. She then removed the lid from the can labeled americium and found several thin layers of lead shielding. She removed two lead disks that covered the top of the shielding and found a small glass bottle and about a dozen small glass tubes, all of which contained material. She placed the lead disks back on top of these items and closed the can. The employee left the area, informed her team leader of the findings, and requested that the Material Control and Accountability group identify the material. Material Control and Accountability personnel confirmed the material was americium and neptunium, as labeled. The NMT-11 employee asked waste management personnel how to properly discard the materials in the cans. They told her that the materials, now called "waste," needed to be repackaged in clean containers before further characterization and eventual disposal.

Investigators determined that up to this point, neither the employee nor her team leader had informed Health Physics Operations or CMR facility management that they had discovered previously unidentified radioactive materials in the chemical hood.

On November 6, the NMT-11 employee, working alone and without RCT coverage, double-bagged the carton of neptunium, surveyed it, and sealed it in a clean can. The employee used the survey instrument near the room exit to perform all surveys. Concerned with potential radiation from the material, she placed the can 10 feet from the hood. The employee returned to the hood, opened the can of americium, and removed the lead disks. Using tweezers, she then removed the small tubes and the glass bottle from the can and double-bagged them. After surveying the bag, she sealed it in a clean can and placed it away from the hood with the other can.

On November 9, while preparing to discard the can labeled as americium, the employee found yet another tube of material inside it that had to be packaged with the other tubes. The next day, she repackaged the tube found the day before with the other small glass tubes and bottle. While being used to self-monitor her gloved hands and booties, the survey instrument alarmed. The employee then noticed a bag and piece of foil on the floor near the hood. Still wearing gloves, she picked up the foil and bag and placed them into the hood. She returned to the survey instrument, which alarmed again as she moved her gloved hand near the probe.

The NMT-11 employee changed her gloves and tried to locate a phone to call for assistance. She walked into an adjacent room and then placed large plastic bags over her booties before entering a corridor, where she notified someone. RCTs responded and established barriers to the corridor and performed a whole-body survey of the employee. They detected 56,000 dpm of alpha activity on her lower left pant leg and 3,000 dpm on the left arm of her lab coat. A second survey found 29,000 dpm on the right side of her pants, 1,000 dpm on the left side of her shirt, 800 dpm on the tip of her right middle finger, and a few hundred dpm on the badge on the outside of her lab coat. RCTs detected up to 500,000 dpm of alpha activity on the floor in the two rooms. Dose readings of the can containing the americium were greater than 500 mrem/hr on contact.

NFS has reported numerous violations of radiological procedures in several Weekly Summaries. It reported in Weekly Summary 96-30 the assessment of a civil penalty under the Price-Anderson Amendments Act against Westinghouse Hanford Company for violations that resulted in a pipe fitter receiving a 13 rem radiation dose to his hands. Following are some examples involving extremity exposures.

- Weekly Summary 98-31 reported that fissile material handlers at Los Alamos National Laboratory did not wear extremity monitoring dosimetry (finger-rings) while handling nuclear material containers containing significant quantities of plutonium, violating facility procedures. Investigators determined that the handlers' failure to wear finger-ring dosimetry has been an ongoing issue since at least April 29, 1998. (ORPS Report ALO-LA-LANL-TA55-1998-0036)

- Weekly Summary 97-09 reported that a hot cell operator at the Idaho National Engineering Laboratory received an extremity dose of 3.15 rem to his right hand and 1.1 rem to his left hand when he touched an irradiated sample while sliding it into a lead cask. The operator was working with samples that had higher radiation levels than usual. Investigators determined that inadequate planning resulted in the extremity exposure. (ORPS Report ID--LITC-TRA-1997-0005)

- Weekly Summary 96-13 reported that a chemical technologist and a health physics technician at the Hanford Analytical Laboratory handled a sample vial that was in excess of the RWP limit of 10 rad/hr. The workers failed to follow the measure-before-handling policy and handled the sample vial containing radioactive liquid by hand before dose measurements were made. When the vial was surveyed, the measured dose rate was 198 rad/hr at a half-inch distance. (ORPS Report RL--WHC-ANALLAB-1996-0014)

This event illustrates the need for a conservative approach to radiological work as soon as it is realized that radiological conditions are not as foreseen. The NMT-11 employee should have immediately stopped work when she determined that the cans were not empty but contained legacy material. A work/task plan should have been prepared, along with a task-specific RWP, pre-job surveys of the material, and support by RCT personnel. Such a plan should address methods such as tongs and shielding for minimizing exposure to the employee when handling radioactive material. Also, extremity dosimetry should be used in addition to standard personal dosimetry.

DOE/EH-0256T, *Radiological Control Manual*, chapter 1, emphasizes the DOE radiological control policy that is based on adherence to As Low As Reasonably Achievable principles and ownership, whereby each person is expected to demonstrate responsibility and accountability toward radiation and radioactivity. Chapter 3 states that technical work documents, such as procedures, are to be used to control hands-on work with radioactive materials. It designates the RWP as an administrative mechanism to establish the radiological controls for intended work and limiting radiological conditions.

KEYWORDS: contamination, extremity exposure, radiation protection, work planning

FUNCTIONAL AREAS: Radiation Protection

3. FAILURE TO INCLUDE FIRE HAZARD ANALYSIS REQUIREMENTS IN AUTHORIZATION BASIS AT OAK RIDGE

On November 4, 1998, at the Oak Ridge Site Y-12 Nuclear Operations Facility, the enriched uranium operations manager reported that fire hazard analysis requirements were not included in the Basis for Interim Operations (BIO), resulting in a potential unreviewed safety question. Facility fire hazard analysis limits combustible loading and maintains an operable fire suppression system in one wing of the facility where safe bottles are stored. Safe bottles are capped and vented tubes that hold approximately 11 gallons each of uranium-bearing liquid. Surveillances were not being performed with sufficient rigor to ensure system operability or to limit organic material storage (including safe bottles). The facility manager suspended operational and maintenance activities until compensatory measures could be identified and implemented. The facility manager directed facility personnel to ensure that other fire hazards analysis scenarios and safety analysis documents are adequately reflected in the BIO. Fire hazards analyses are necessary to prevent injury, fatalities, equipment and facility damage, and uncontrolled radiological releases. However, if the analyses are not adequately reflected in authorization bases, these hazards cannot be adequately controlled or limited. (ORPS Report ORO--LMES-Y12NUCLEAR-1998-0086)

DOE investigators determined that the situation had not been properly evaluated nor had adequate information been provided to technically justify not classifying the fire suppression system as equipment important to safety. They also determined that the consequences of a multiple safe bottle fire are "intolerable and exceed the currently used evaluation guidelines." DOE investigators examined an unreviewed safety question determination prepared by the contractor and agreed to accept the risk increase for 15 days if compensatory measures are implemented in the facility wing. Following are some of the DOE required compensatory measures.

- No one shall introduce additional organics into the wing.
- No one shall handle or process organics without DOE concurrence.
- No one shall perform hot work in the wing without specific prior written approval from a fire protection engineer and the operations manager's concurrence.
- No one shall use organics for production runs until the unreviewed safety question is resolved.
- Facility personnel shall (1) ensure adequate water pressure and proper system alignment are verified before declaring the fire suppression system operable and (2) ensure the associated fire alarms actuate if the fire suppression system activates, and (3) initiate an hourly fire patrol.

NFS has reported several events involving violations of facility authorization bases in the Weekly Summary. Following are some examples.

- Weekly Summary 98-42 reported that an inspector at the Rocky Flats Environmental Technology Site Plutonium Processing and Handling Facility discovered two transuranic waste drums whose vents were covered by tamper-indicating devices, violating the facility BIO. The accident analysis in the BIO assumes drums are properly vented, reducing the frequency of hydrogen explosions and resulting in lower risk class reduction categorizations. The facility manager reviewed this event and reported a potential unreviewed safety question because there is no program to inspect and test transuranic waste drum vents. (ORPS Report RFO--KHLL-371OPS-1998-0076)
- Weekly Summary 98-02 reported three occurrence reports submitted by Los Alamos National Laboratory personnel about fire alarm panel problems. On January 7, 1998, fire

protection personnel discovered a de-energized fire panel. The circuit breaker for normal ac power to the panel was open and the backup batteries were depleted. On January 8, an operations mentor discovered that a test procedure for a fire panel could have compromised the ability of facility personnel to respond to a fire during panel testing. On January 9, removal of a compensatory fire watch before completion of surveillances on this same fire panel resulted in a violation of the facility Operational Safety Requirements. (ORPS Reports ALO-LA-LANL-PHYSCOMPLX-1998-0001, ALO-LA-LANL-CMR-1998-0001, and ALO-LA-LANL-CMR-1998-0002)

- Weekly Summary 97-39 reported that the Facility Plant Review Committee at a Hanford reprocessing facility reported an unreviewed safety question because ventilation system modifications made in 1969 were not in accordance with the Safety Analysis Report (SAR). The committee agreed that the modifications would cause the filters to collapse during a design basis fire, leading to an unfiltered radioactive release through the main stack. The failure of the filters did not coincide with the accident scenario analyzed in the SAR. (ORPS Reports RL--PHMC-324FAC-1997-0010 and RL--PHMC-324FAC-1997-0014)

NFS reported a Savannah River good practice in Weekly Summary 94-48 that linked databases for compliance with safety requirements. A Defense Nuclear Facilities Safety Board assessment noted the positive aspects of a linking database that relates requirements of various authorization basis documents (SARs, Operational Safety Requirements, and technical standards) to the field implementation of those requirements. The linking database coordinates other programs, such as surveillance testing, and combines the information into one system. All safety limits associated with specific systems and components can be identified using the database. Facility personnel can query the database about a particular procedure or test to determine which safety requirements are addressed by the procedure. The linking database also allows facility personnel to easily determine if new procedures or procedure revisions are needed if authorization requirements change.

These events illustrate the importance of properly tracking, scheduling, and conducting surveillances. Managers need to ensure that surveillance requirements are incorporated into facility practices. Hazardous materials must be adequately tracked to ensure facilities remain within their authorization basis documents. DOE contractors who operate nuclear facilities and fail to conduct required surveillances or implement corrective actions for identified deficiencies could be subjected to Price-Anderson civil penalties under the work processes and quality improvement provisions of 10 CFR 830.120, *Quality Assurance Requirements*. Facility managers should review their surveillance practices to ensure that scheduled frequencies are as specified in their safety documentation. They should also review their facilities with respect to the authorization bases to ensure that all fire protection standards are met. Managers also need to ensure that installed equipment is evaluated when safety documentation changes the requirements for that equipment.

Facility managers should review the following information and then communicate to facility personnel the importance of adequately reflecting the facility design bases in authorization basis documents and procedures. They should also review the following guidance and ensure that events are adequately characterized and corrective actions are effectively implemented to reduce the recurrence of events.

- DOE O 420.1, *Facility Safety* (previously 5480.7A, *Fire Protection*), section 4.2, "Fire Protection," describes the requirements for comprehensive fire protection programs to meet fire safety objectives to minimize the potential for (1) the occurrence of a fire or related event, (2) a fire that causes an unacceptable on-site or off-site hazardous radioactive release, (3) unacceptable interruptions in vital DOE programs as a result of fire and related hazards, (4) property losses for a fire and related events that

exceed established DOE limits, and (5) damage of critical process controls and safety class systems as a result of a fire and related events.

- DOE O 5480.21, *Unreviewed Safety Questions*, establishes program requirements to evaluate the impact of changing conditions that may affect authorization bases. It also ensures that DOE has the approval authority for changes that introduce new hazards and higher-than-approved risks to the public and facility workers. The Order states that when changes are made to the facility, three criteria are used to identify unreviewed safety questions: (1) if the probability of occurrence or the consequences of an accident that is analyzed in the SAR are changed; (2) if the possibility of an accident of a different type than analyzed in the report may be created; and (3) if the margin of safety, as defined in any technical specification, is reduced.

- DOE O 5480.22, *Technical Safety Requirements*, attachment 1, describes the purpose of surveillance requirements and states that each surveillance shall be performed within the specified interval.

- DOE O 5480.23, *Nuclear Safety Analysis Reports,* states that it is DOE policy to analyze nuclear facilities and operations to (1) identify all hazards and potential accidents associated with the facility and the process systems, components, equipment, or structures and (2) establish design and operational means to mitigate these hazards and potential accidents. The results of these analyses are to be documented in SARs. This Order also requires periodic review and updates of SARs to ensure that information is current and remains applicable.
- DOE-HDBK-1062-96, *Fire Protection Handbook*, August 1996, provides guidance for establishing comprehensive fire protection program requirements. The handbook states that (1) all fire protection system information should be documented in the appropriate level of detail, (2) fire protection documents should be reviewed by a person competent in the subject area, and (3) fire protection documents should be approved by the fire protection manager before use. DOE handbooks are available at http://www.doe.gov/html/techstds/standard/standard.html.

- DOE/EH-0502, Safety Notice 95-02, *Independent Verification and Self-Checking*, September 1995, provides guidance and good practices for performing independent verification. Safety Notice 95-02 can be obtained by contacting the ES&H Information Center, (800) 473-4375, or by writing to U.S. Department of Energy, ES&H Information Center, EH-72, 19901 Germantown Rd., Germantown, MD 20874. Safety Notices are also available at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

KEYWORDS: surveillance, test, compliance, fire protection, operational safety requirement, safety analysis, accident analysis, authorization basis

FUNCTIONAL AREAS: Fire Protection, Licensing/Compliance, Procedures, Surveillance

4. RADIOACTIVE SOURCE FALLS FROM HOLDER AT OAK RIDGE

On November 3, 1998, at the Oak Ridge Y-12 Nuclear Operations Facility, a radiological control technician conducting a routine contamination survey discovered an unsecured ytterbium-169 source on the floor of a nondestructive analysis laboratory. The source measured 2,000 mrem/hr on contact, 95 mrem/hr at 1 foot, and 10 mrem/hr at 3 feet. As directed by the shift manager, the technician used tongs to transfer

the source to a lead shield and stored the source and shield in a source cabinet. The radiological controls group promptly analyzed the dosimetry of 11 persons who entered the laboratory during the time investigators believe the source was exposed. The results showed no significant exposure; however, uncontrolled sources always have the potential to cause unplanned radiation exposures. (ORPS Report ORO--LMES-Y12NUCLEAR-1998-0084)

The facility manager led a critique of the occurrence, and attendees learned the following.

- The source normally is contained in the bore of a shielded collimator that is part of a scanning device. The bore diameter is approximately one-eighth inch and the source diameter is approximately one-sixteenth inch.

- On the day before the source was discovered, laboratory personnel removed the collimator to allow maintenance on the scanning device and reinstalled it when maintenance was completed. Investigators believe the source fell from the collimator bore during these activities.

- The collimator is of a new type designed to minimize the probability of a source falling from it; however, some vendors supply sources smaller than the collimator bore.

- The radiation work permit written for the maintenance activities did not require coverage by a radiological controls technician.

- Although laboratory personnel were aware that the collimator contained a radioactive source, they did not perform a source check after they reinstalled it.

NFS has reported on the loss of control of radioactive sources in several Weekly Summaries. Following are some examples.

- Weekly Summary 98-26 reported that a nondestructive analysis worker at Rocky Flats Environmental Technology Site Non-Plutonium Operations Area III lost a 3.5-microcurie barium check source when he left it unattended. Investigators believe that operations personnel accidentally swept up the source along with other debris and that sanitary workers employed by a private sanitary waste company may have transported it to an off-site landfill. (ORPS Report RFO--KHLL-NONPUOPS3-1998-0003)

- Weekly Summary 98-06 reported that a facility manager at the Rocky Flats Environmental Technology Site reported loss of accountability for a sealed, 150-millicurie tritium source contained in an electron-capture detector and installed in a gas chromatograph. Property utilization and disposal personnel received the gas chromatograph from the plutonium manufacturing and assembly complex, opened it, discovered the source, and notified radiological control personnel because they recognized the trefoil symbol. (ORPS Report RFO--KHLL-FACOPS-1998-0002)

- Weekly Summary 96-16 reported that a radiological control technician performing a routine radiological survey at Rocky Flats discovered what he thought was a contaminated drum ring bolt on top of a storage drum. Radiological engineers examined the device and determined that it was a radioactive source holder with a threaded cap and that it contained a 10-millicurie cesium-137 source. Technicians measured 1,000 mrem/hr on contact with the source holder and 24 mrem/hr at 30 cm. The source was not in the site source registry, and investigators could not trace its whereabouts after 1989.

(ORPS Report RFO--KHLL-771OPS-1996-0052)

These events underscore the importance of strict accountability for radioactive sources and demonstrate the need for a strong radioactive source control program. All radioactive materials have specific handling requirements. DOE maintains a regulatory position paper on sealed radioactive source controls that delineates proposed requirements similar to those of the NRC. The position paper states that "these requirements were determined to be necessary for an adequate radiation protection program." At Oak Ridge, loss of control of a significantly radioactive source for up to 24 hours could have exposed as many as 11 persons to unexpected radiation. If not for a routine survey, the source could have remained uncontrolled for much longer than it was. Investigation of this occurrence is incomplete; however, managers determined that audible dosimetry and a radiological controls presence, a more thorough safety review for a design change to radiation-generating equipment, and a post-maintenance source check would have prevented this occurrence.

Personnel responsible for the control of radioactive sources at DOE facilities should review the following guidance to ensure adequate accountability for sources.

- DOE/EH-256T, *Radiological Control Manual,* requires control and accountability for sealed radioactive sources. It states that each person involved in radiological work is expected to demonstrate responsibility and accountability through an informed, disciplined, and cautious attitude toward radiation and radioactivity. The manual sets forth DOE guidance on the proper course of action in the area of radiological control, including work preparation; work controls; monitoring and surveys; and training and qualifications. Section 123, "Worker Responsibilities," states that trained personnel should recognize that their actions directly affect contamination control, personnel radiation exposure, and the overall radiological environment associated with their work.

- DOE Implementation Guide G-N 5400.9/M1-Rev.1, *Sealed Radioactive Source Accountability and Control*, provides guidance for establishing and operating a sealed source accountability and control program. Specific guidance includes organization and responsibilities, receipt, labeling and storage, inventory, integrity testing, and handling and disposal.

Links to DOE radiation protection documents, including the sealed source position paper, can be found at http://tis-nt.eh.doe.gov/wpphm/regs/regs.htm. The NRC maintains a sealed source database. The database can be found at http://www.NRC.gov/NRC/FEDWORKD/NRC-SSD/index.html. This database provides a list of sealed sources licensed by the NRC and a variety of information on sealed sources.

KEYWORDS: sealed source, accountability, radiation protection

FUNCTIONAL AREAS: Radiation Protection

5. WORKERS SPRAYED WITH CONTAMINATED WATER

On November 10, 1998, at the Hanford Tank Farms, two workers were sprayed with contaminated water as they attempted to unplug the drain in a valve pit using a water lance. The workers were sprayed directly onto their faces and body surfaces. Nasal smears for both workers were positive for

contamination; however, bioassay and whole body counting results indicated no internal contamination. The work was performed under a routine work request, which is issued for low-risk, minor corrective maintenance activities. The work was also performed under a general radiological work permit (RWP), so no work package or procedure was developed. The workers were dressed in gloves, rubber booties, and a single pair of coveralls; the RWP did not require workers to wear other personal protective equipment such as respirators, face shields, safety glasses, or plastic coveralls. Unanalyzed hazards of working with a high-pressure water stream in proximity to radioactively contaminated water resulted in personnel contamination. (ORPS Report RL--PHMC-TANKFARM-1998-0139)

Investigators determined that a supervisor operated the water lance. He inserted the tip of the lance into soft sand and standing water at the bottom of the valve pit and an operator started the pump. The supervisor believed that the tip of the lance was plugged, so he lifted the tip from the bottom of the pit. The obstruction broke free and the sudden flow of pressurized water into the standing water in the bottom of the pit caused contaminated water to spray out of the pit onto the supervisor, a health physics technician, and the surrounding area. Health physics technicians assisted with surveys and decontamination of the workers and surrounding areas. Facilities used to support decontamination of the workers did not have a shower that drained to a segregated catch tank, so they washed with soap and water over waste drums. The facility manager proposed corrective actions that included reviewing roles and responsibilities for facility personnel, reviewing facility requirements for routine work requests, evaluating the adequacy of decontamination facilities, and having engineers review the system used for removing obstructions from plugged pit drains.

NFS has reported numerous events in the Weekly Summary where contaminated or hazardous liquids were sprayed onto or near workers. Following are some examples.

- Weekly Summary 98-17 reported that an operator at the Idaho National Engineering and Environmental Laboratory Chemical Processing Plant was slightly injured when a flexible hose being used to empty an acid transfer header to a floor drain lifted out of the drain and sprayed him with a nitric acid mist. Two operators were using an approved procedure to blow down the header with pressurized air following an acid transfer. The procedure did not require the operators to wear personal protective equipment or require an operator to secure the hose to the floor drain. Investigators determined that inadequate procedures resulted in an operator being sprayed. (ORPS Report ID--LITC-WASTEMNGT-1998-0006)

- Weekly Summary 98-10 reported that an operator at the Oak Ridge Environmental Restoration Facility was removing a blank flange from an isolated low-level liquid waste transfer line when contaminated liquid sprayed from the flange. No personnel were contaminated, but the internal surface of the concrete containment basin, a valve box, and a 1-square-foot area outside the basin indicated contamination levels of 14 mrad/hr beta-gamma and 65,000 dpm/100 cm^2 alpha. If the work planners and supervisors had checked the piping arrangement, they would have recognized that the low point could be under pressure. (ORPS Report ORO--LMES-X10ENVRES-1998-0002)

- Weekly Summary 97-49 reported that an operator at the Idaho National Engineering and Environmental Laboratory Advanced Test Reactor was sprayed with approximately 50 milliliters of sulfuric acid foam while disconnecting an air hose to the air sparge line of an empty 8,000-gallon, bulk-acid storage tank. Procedures did not consider the sparge line air hose connection to be inside the boundaries of the work zone. Corrective actions included performing a job safety analysis and revising procedures accordingly. (ORPS Report ID--LITC-ATR-1997-0025)

These events underscore the importance of using effective work control practices and detailed pre-job planning. Safety and health hazard analysis must be included in the work control process to help prevent worker injury and should include provisions for drawing reviews, job-specific walk-downs, and personnel protective equipment. DOE facility managers should ensure that personnel understand the basics of work control practices and work planning. These events also underscore the importance of using well-written procedures. Following are some documents that facility managers should review to ensure they are incorporated in work control programs.

- DOE O 4330.4B, *Maintenance Management Program*, section 8.3.1, provides guidelines on work control systems and procedures. The Order states that work control procedures help personnel understand the necessary requirements and controls.

- DOE-STD-1050-93, *Guideline to Good Practices for Planning, Scheduling and Coordination of Maintenance at DOE Nuclear Facilities*, section 3.1.1.3, provides the key elements of an effective planning program. The standard also discusses the need for thorough reviews of work packages by experienced individuals to eliminate errors.

- DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter XVI, "Operations Procedures," states that appropriate attention should be given to writing, reviewing, and monitoring operations procedures to ensure that the content is technically correct and the wording and format are clear and concise. Operations procedures should be sufficiently detailed to perform the required functions safely and without direct supervision. Operators should not be expected to compensate for shortcomings in procedures such as poor format or confusing, inaccurate, or incomplete information.

- DOE-STD 1029-92, *Writer's Guide for Technical Procedures*, provides guidance to assist procedure writers in producing accurate, complete, and usable procedures that promote safe and efficient operations.

KEYWORDS: work control, hazard analysis

FUNCTIONAL AREAS: Work Control, Industrial Safety